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# DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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October 9, 1997

The Honorable Alvin L. Alm  
Assistant Secretary for Environmental Management  
Department of Energy  
Washington, D.C. 20585

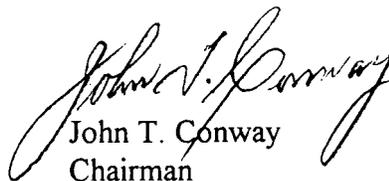
Dear Mr. Alm:

Defense Nuclear Facilities Safety Board (Board) staff review teams have visited the Savannah River Site several times this year to review implementation of Recommendation 96-1 at the In-Tank Precipitation (ITP) Facility, and to assess the authorization basis and safety programs for the high-level waste tank farms. The Board requested Mr. R. Tontodonato of the Board's staff to review the reports of these visits and to summarize these findings for us. The enclosed report is his **summary** of the issues identified during each site visit and the progress made in resolving each open item.

There are several key issues the Board would like to draw to your attention. The numerous observations made by our staff regarding the ITP nitrogen inerting systems make it clear that great care must be taken to ensure these systems are rigorously effective and reliable. Furthermore, the staff's observations regarding controls on ITP pump operations highlight the fact that ITP appears to be developing an undue reliance on administrative controls. Engineered controls would be preferable, to the extent that they are practical, for a facility facing such a long and technically demanding mission. Finally, the prolonged discussions that have taken place regarding the accident analyses and controls for hydrogen deflagrations in waste tanks and waste tank overheating indicate that closure of these issues is proving difficult and may warrant increased scrutiny from the Department of Energy. The Board is closely following the progress of the research on the chemistry of the ITP process, and the results that continue to come in with bearing on the safety of the process.

The enclosed reports provide a synopsis of the observations made during the reviews conducted by the Board's staff and are forwarded for your consideration. If you have any questions, please feel free to call me.

Sincerely,

  
John T. Conway  
Chairman

c: Mr. Mark Whitaker

Enclosures

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

May 7, 1997

**MEMORANDUM FOR:** G. W. Cunningham, Technical Director

**COPIES:** Board Members

**FROM:** T. Davis

**SUBJECT:** In-Tank Precipitation Facility and Tank Farm Instrumentation and Control Systems

## 1. Purpose

This report documents observations regarding instrumentation and control (I&C) systems at the In-Tank Precipitation (ITP) Facility and tank farms at the Savannah River Site (SRS). These observations were made by members of the Defense Nuclear Facilities Safety Board's (Board) staff T. Davis and D. Napolitano during a visit to SRS on April 29–May 1, 1997.

## 2. Summary

The following observations summarize the conclusions of the review by the Board's staff:

- The current ITP safety strategy does not limit the length of time for which the standby nitrogen purge system is used. Because fuel control is not maintained while the standby system is in use, the tank vapor could reach the lower flammability limit (LFL). Additionally, oxygen monitoring is not required to confirm that the standby system is properly inerting the vapor space.
- Based on instrument uncertainty and surveillance frequency, the tank farms may exceed the guidelines of National Fire Protection Association (NFPA) 69, *Explosion Prevention Systems*, for hydrogen concentration in the tank vapor space.

- For some safety-class equipment, Westinghouse Savannah River Company (WSRC) is performing analyses to determine whether safety-class requirements can be relaxed, which could reduce equipment reliability.
- The accuracy and reliability of I&C systems could be improved at ITP and the tank farms by implementing an instrument calibration trending program, and by improving the flammability analyzer testing and surveillance program.
- The safety-class nitrogen system at ITP is not fully protected by the lightning protection system. Additionally, there has not been an evaluation of the potential effects of lightning at the tank farms.

### 3. Background

Based on Recommendation 96-1, WSRC is conducting testing to understand ITP chemistry and identify the appropriate process controls. The current ITP schedule is to begin readiness reviews in September 1997 and processing operations in December 1997. The tank farms plan to replace the current Operational Safety Requirements with new Technical Safety Requirements (TSRs) by September 1997.

### 4. Discussion

**ITP Safety-Class Nitrogen Purge.** Under the current ITP safety strategy, a seismically qualified safety-class nitrogen system (standby system) provides oxygen control when the normal system is not available. Unlike the normal purge system, the standby system does not provide for control of flammable vapors. Therefore, the tank could reach the LFL if this system were used for an extended time. TSR guidance limiting the time in standby mode may be appropriate. Additionally, there is no requirement to maintain oxygen monitoring capability when using the standby system. Monitoring of oxygen concentration would provide assurance that the tank vapor space is adequately inerted.

**ITP and Tank Farm LFL Analyzers.** At both ITP and the tank farms, only a single analyzer is permanently installed, and a portable analyzer is used periodically to verify its readings. The Board's staff noted the following issues:

- At the tank farms, the uncertainty of the LFL analyzers (approximately 10 percent LFL) and the surveillance frequency could allow tanks to reach 30–40 percent LFL. This does not appear to meet the requirements of NFPA 69, which requires monitoring programs to ensure that vapors do not exceed 25 percent LFL.
- The portable monitors are maintained by a site-wide organization, which does not normally handle safety-related instruments. Because these portable analyzers are used to perform a safety function, additional requirements for calibration and testing are necessary; however, this testing is not controlled by an appropriate safety-related procedure.
- LFL analyzers are currently calibrated with 50 percent LFL gas, as recommended by the vendor. However, alarms and interlocks are set at 10–25 percent LFL. Using a calibration gas closer to the alarm and interlock set points in addition to the vendor-recommended gas would ensure that these instruments are properly calibrated in the range of interest.

**Safety-Class Equipment Design.** The WSRC backfit methodology allows some design requirements for existing and new equipment to be relaxed. Instead, compensatory measures or a probabilistic analysis is used to justify the adequacy of equipment design. Specifically, this approach is being considered for the new safety-class oxygen analyzers because of the excessive cost identified by the vendor for fully qualified equipment. WSRC is negotiating with the analyzer vendor to determine whether removing Institute of Electrical and Electronics Engineers (IEEE) standards would reduce the cost of the analyzers. Additionally, the analyzers will not have a safety-class power supply, and therefore would not be operable during an extended power outage (i.e., when the standby nitrogen system was operating). A final decision on equipment design has not been made. The impact on equipment reliability will be reviewed on a case-by-case basis as WSRC completes its backfit analyses and equipment designs.

**Trending of Instrument Calibrations.** Safety-related instruments are calibrated periodically to ensure that they have not drifted out of the required tolerance band. However, there is no program for trending instrument performance and predicting failures based on calibration results. A formal trending program in accordance with DOE Order 4330.4B to track instrument performance and predict failures would increase instrument accuracy and reliability.

**Lightning Protection Systems.** The safety-class nitrogen system at ITP has not been evaluated for the effects of lightning. The electrical systems that initiate and control this system are located near the new nitrogen tanks and are not protected by ITP lightning protection. Because of the importance of this system, it would be prudent to evaluate the effects of lightning on the standby nitrogen system.

There is currently no lightning protection system at the tank farms. Additionally, an evaluation of the potential effects of lightning in accordance with NFPA 780, *Lightning Protection Code*, has not been performed.

## **5. Future Staff Actions**

The Board's staff will perform an additional review of ITP I&C systems prior to startup to ensure that these systems adequately support the ITP safety basis.